



U.S. Department  
of Transportation  
**Federal Aviation  
Administration**

# Advisory Circular

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**Subject:** DISPLAYING GEOMETRIC  
ALTITUDE ABOVE MEAN SEA LEVEL

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**Date:** mm/dd/08  
**Initiated by:** AIR-100

**AC No:** 20-XXX

## 1. Purpose of this AC.

a. This advisory circular (AC) shows you how to gain a type certificate (TC), supplemental TC (STC), amended TC (ATC), amended supplemental TC (ASTC), or technical standard order (TSO) authorization for systems incorporating the presentation of geometric altitude on electronic displays.

b. This AC is not mandatory and does not constitute a regulation. In it, we describe an acceptable means, though it is not the only means, to gain approval. If you use the means described, you must follow it in all important respects.

**2. Whom this AC Applies to.** We wrote this AC for aircraft and avionics manufacturers and designers of electronic displays on any type of aircraft (that is, Title 14 of the Code of Federal Regulations (14 CFR) parts 23, 25, 27, and 29).

## 3. Geometric Altitude, Defined.

a. We define geometric altitude in this AC as the height above mean sea level (MSL) that is derived primarily from systems not affected by local barometric pressure such as a global positioning system, or GPS. Geometric altitude is therefore distinct from barometrically derived height, and also distinct from height above reference surfaces other than MSL.

b. We will not use formal geodetic terminology in this AC. Rather, we refer to the term “geoid” (the undisturbed MSL extended continuously through the continents) as “MSL.” Likewise, we refer to “orthometric height” (height of a point relative to the geoid) here as “geometric altitude.”

## 4. Considerations For Displaying Geometric Altitude.

a. Barometrically derived altitudes are required for pilot compliance with published and air traffic controller-issued altitudes within the National Airspace System.

b. The coexistence of geometric and barometric altitudes in the flight deck may confuse pilots, because of geometric altitude’s reference to MSL. For example, both geometric and

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corrected barometric altitude represent the same measurement parameter (height above MSL), even though they differ by how they're derived, and hence their error characteristics.

c. Incorrect use of geometric altitude in one aircraft could reduce the margin of vertical aircraft separation, because other aircraft are using barometric altimeters—with the same error characteristics among them—to comply with published and controller-issued altitudes.

d. It is, therefore, important that the display of geometric altitude is clearly identifiable and distinguishable from the display of barometric altitude, so pilots won't confuse them and risk a reduction in vertical aircraft separation.

**5. TSO Deviations.** Displaying geometric altitude is currently not required by 14 CFR, but covered in FAA TSO-C151b, *Terrain Awareness and Warning System (TAWS)* regarding alerts for Class C systems. Class C TAWS applicants for TSO-C151b should request a TSO deviation to Appendix 4, Paragraph 2.0, "1.2. Altitude Accuracy" until we revise the TSO.

**6. Exclusions.** This AC does not:

a. Apply to hybrid altimeters that comply with TSO-C10b, *Altimeter, Pressure Actuated, Sensitive Type*, and other performance requirements for static pressure altimeters.

b. Cover the intended functions of geometric altitude that we will accept. You are responsible for proposing an acceptable intended function.

c. Cover ellipsoidal height referenced to the WGS-84 (World Geodetic System — 1984) geodetic reference datum and other GPS derived altitudes not referenced to MSL.

**7. Summarized Guidance For Displaying Geometric Altitude.** To display geometric altitude, applicants should:

a. Label the altitude value clearly, omitting "MSL," even if enhanced with modifiers such as in "MSL/G." We recommend the label "GSL," which might represent "geometrically derived height above mean sea level." See paragraph 7.

b. State the intended function clearly and with enough detail for us to evaluate if the system you propose is appropriate for the intended function(s). We won't accept vague descriptions of intended functions, such as "for situation awareness." See paragraph 8.

c. Insert explanatory/cautionary notes in the airplane or rotorcraft flight manual (AFM or RFM), AFM/RFM supplement, pilot operating guide, or equivalent pilot reference. Include explicit wording that pilots should **not** use the display of geometric altitude to comply with published or controller-issued altitudes. See paragraph 9.

**8. Labeling Geometric Altitude Value.** The geometric altitude label should give the pilot key information, such as the height measurement reference (as with MSL, AGL (above ground level), and FL (flight level), whose reference is the actual 29.92-inch Hg isobar surface).

Another key piece of information is the derivation source, such as barometry, GPS, or radar. Other considerations for the label are:

**a.** To ensure that pilots can easily discern geometric altitude from barometric altitude, display the geometric altitude in accordance with 14 CFR §§ 23.1301, 25.1301, 27.1301, or 29.1301.

We recommend that the geometric altitude label:

- Is intuitive to pilots,
- Is compatible with aviation language,
- Specifies that the derivation source is not entirely barometric, and
- Specifies that the measurement reference is mean sea level.

**b.** Previous suggestions for the geometric altitude label have included “MSL” to convey the height measurement reference. However, due to the historical association between MSL and barometry, using “MSL” in the label can be misleading and potentially unsafe. Therefore, we don’t recommend “MSL” as all, or part, of the geometric altitude label.

**c.** We recommend limiting the label to no more than three characters in length. The character limit minimizes the cost of modifying existing displays, some of which can accept no more than three characters.

**d.** We recommend “GSL” as a label for geometric altitude because it satisfies the above guidance.

## **9. Statement Of Intended Function.**

**a.** Your statement of intended function must be sufficiently specific and detailed for us to decide if the system is appropriate for the intended function, in accordance with 14 CFR §§ 23.1301, 25.1301, 27.1301, or 29.1301.

**b.** Use the following sample questions to help you decide whether your statement of intended function or electronic displays and associated tasks are descriptive enough:

**(1)** What assessments, decisions, or actions should the flight crew members make based on the system’s display?

**(2)** What other information will be used in combination with the system’s display?

**(3)** What is the assumed operational environment in which the equipment will be used?

**(4)** What are the design assumptions about the pilot population, characteristics, and expectations?

## 10. Example of Explanatory Text.

a. The following paragraph is an *example* of text that you might use in an airplane or rotorcraft flight manual (AFM or RFM), AFM/RFM supplement, pilot operating guide, or equivalent pilot reference, to describe the limitations of the aircraft's display of geometric altitude:

Geometric altitude is the calculated height above mean sea level. Geometric altitude is calculated by the TAWS system using GPS altitude obtained from the airplane's GPS system, a database to convert to the GPS altitude to a mean sea level reference, and short-term pressure altitude variations obtained from the airplane's altimeter system. Geometric altitude is displayed in the upper left corner of the TAWS screen and labeled "GSL."

Geometric altitude will often differ from corrected barometric altitude displayed on the airplane altimeter. This is mainly because geometric altitude is based primarily on GPS measurements, versus atmosphere information (pressure, temperature, and lapse rates). If the TAWS monitoring system detects an unreasonably large difference between geometric altitude and corrected barometric altitude, an amber message "CHECK ALT" will be displayed below the geometric altitude display for as long as the discrepancy exists.

The National Airspace System is based on barometric altitude. Therefore, the displayed value of geometric altitude is not permitted to be used by pilots for compliance with published or controller-issued altitudes.

b. Your actual text should reflect the specific design and intended function(s).

## 11. Effect Of Policy.

a. As stated in paragraph 1, this AC is not a new regulation. However, if you're an applicant, you should expect that certificating officials may rely on this information when making findings of compliance during the certification process.

b. If your proposed method for showing compliance falls outside the guidance in this AC, you may expect your aircraft certification office (ACO) to coordinate with the AC-issuing office.

c. If you have questions regarding this AC or request more information, call the FAA Aircraft Certification Service, Avionics Systems Branch, AIR-130, at (202) 267-4685.

**12. Related References.** Title 14 of the Code of Federal Regulations (14 CFR) §§ 23.1301, 25.1301, 27.1301, or 29.1301.

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